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The Effects of Six Sigma Approach on Business Performance: A Study of White Goods (home appliances) Sector in Turkey

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Abstract

Increasing global competition in the world economy forces firms to sharpen their functionality and processes in order to gain competitive advantages. For this reason, many firms develop management systems. These methods provide interdisciplinary approaches including statistics and operational research which encompasses structure of the firm, market conditions, consumer needs and changes in economy and technology. These methods incorporate six sigma approach. The six sigma approach emerged in the 1980's. It provides important and better tools in comparing between firms in their pursuit to achieve their targets in the face of other competitors. In this context, the main aim of the study is to investigate the main structure of the six sigma approach and its characteristics and to analyze the effects of six sigma approach on the firm's performance indicators by considering a firm benefiting efficiently from six sigma approach and operating in the white goods sector in Turkey.

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1. Introduction

As there have been increasing global competition in the world's economy, businesses have been equally compelled to improve its services and processes in order to withstand its various competitors. This is evident in

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the tremendous development of management systems of companies in the existing market. These changes include improvements in business structures, market conditions, customer requirements, changes in technology and in the economy (Carreira and Trudell, 2006). There are other approaches in effective management system. However, the emergence of the six sigma approach in the 1980's has brought about massive changes, especially in the areas of efficiency, quality of services and overall management.

In this study, we will be examining the impacts of the six sigma approach on management and to the extent in which in contributes in ensuring the attainment of organizational goals.

2. Literature Review of Six Sigma

2.1. Background

Six-Sigma is a concept that originated from Motorola Inc. in the USA around 1985. At the time, they were facing the threat of Japanese competition in the electronics industry and needed to make drastic improvements in their quality levels (Adams,1998). Six Sigma has gained important attention in the academic and business field due to its financial impact and levels of customer satisfaction (Smith 2003; Arnheiter and Maleyeff 2005; Cheng 2008; Proudlove, Moxham et al. 2008; Shah, Chandrasekaran et al.2008). Different prominent authors such as the famous Zehir, who specializes on total quality management an leadership have written extensively on this topic and have emphasized on the importance of this approach on business development and competitiveness. In his article entitled "Total Quality Management Practices' Effects on Quality Performance and Innovative Performance" and "Relationships Among Total Quality Management Practices: an Empirical Study in Turkish Industry" have explained the effects that this approach can have on organisations (Zehir, et al,2012).

Companies which have adopted Six Sigma have reported increase financial performance in short term (Thomas, Barton et al. 2009), cost reduction (Anchanga, 2006),improvement in customer satisfaction and cost saving (Sharma 2003). On the other hand, not all the companies that implement a Continuous Improvement programed have been able to capture its entire economical benefits (Cusumano 1994; Bossert 2003; Sharma). Many scholars of different angles study six sigma, however, they have argued that the effectiveness of Six Sigma is undermined due to firms misunderstanding or its principles and risk related to its implementation (Bossert 2003; Lee-Mortimer 2006). Companies have to identify and understand its level of Quality Management Adoption in order to achieve proper implementation (Sharma 2003; Lee-Mortimer 2006). Deficient stock of knowledge and monetary resources will no doubt results to its failure. Because of its statistical and parallel organization nature, six sigma demands specific skills to implement its related tools and techniques and economic resources to hire external consultants (Thomasand Web 2003; Lee-Mortimer 2006; Thomas, Barton et al. 2009). Unclear link between strategy and six sigma projects undermined or localized impact and unsustainable improvements is the result of develop six sigma initiatives that don't support the business strategy (Proudlove, Moxham et al. 2008). Six sigma projects are expected to be successful when process are well defined and a relatively stable performance (Lee-Mortimer 2006; Proudlove, Moxham et al. 2008).

Schroeder (Schroeder et al. 2008, p. 540) defines Six Sigma as "an organized, parallel-meso structure used to reduce variation in organizational processes by employing improvement specialists, a structured method, and customer-oriented performance metrics with the aim of achieving strategic objectives." Schroeder (Schroeder et al. 2008, p. 540) note that "companies may choose variations of this base definition when implementing Six Sigma in order to customize it to their situation." Implementing Six Sigma typically involves the creation of an authority structure, dispersed and specialized training efforts, and a cross-functional project execution hierarchy. Many organizations have Six Sigma, including most Fortune 500 companies (Nakhai and Neves, 2009). High profile firms including Motorola, General Electric, and Honeywell helped to promote and legitimize the approach. Researchers have examined whether such innovation adoptions lead to operating performance, improve- mentis that exceed these investments. Examples include studies of the performance effects of total quality management (Yeung et al., 2006), ISO 9000 (Corbett et al., 2005), JIT (Kinney and Wempe, 2002), and Six Sigma (Swink and Jacobs, 2012; Shafer and Moeller, 2012). In a larger theoretical sense, the findings of our study shows that, on average, firms that uses Six Sigma enjoys significantly greater performance gains than the early ones, suggesting the growth of supportive knowledge resources. However, the analysis also shows that the advantages of late adopters tend to be moderated by certain environmental and structural characteristics of a firm.

2.2. Definition of Six-Sigma Approach and Strategies, Tools, Techniques, and Principles

The world economy has in recent times faced massive competition. Most firms that uses the six sigma approach have enjoyed considerable success in all its activities (Atmaca, Ediz and Girenes ,2009).

After the Second World War, there was the need for the improvement in the quality of services provided. There emerges a new philosophy from Japan that emphasized the need for risk analysis and an optimal use of resources. Following the operationalization of this thinking, Japanese companies experienced massive growths in their business (Arumugam, 2013; ChiaJouLin,2013; Dyah Diwasasri Ratnaningtyas,2013). And as a result, countries like the United States of America equally embraced the concept for better quality of services and greater outputs (Atmaca, Ediz and Girenes ,2009).

Following the above explanation, six sigma approach is best defining as follows (Dalgar H.,2010; Eker, B. and Akdoğan A.,2003; Gürsakal and Oğuzlar,2003; Gürsakal N,2005):

Six Sigma: A comprehensive and flexible system for achieving, sustaining and maximizing business success. Six Sigma is uniquely driven by close understanding of customer needs, disciplined use of facts, data, and statistical analysis, and diligent attention to managing, improving, and reinventing business processes. This is the definition that will provide the foundation for our efforts to unlock the potential of Six Sigma for your organization. In other to achieve the benefits of the six sigma approach, the following points below best explains them (Pande, P.S., Neuman, R.P. and Cavanagh, R.R.,).

- Cost reduction
- Productivity improvement
- Market-share growth
- Customer retention
- Cycle-time reduction
- Defect reduction
- Culture change
- Product/service development and many more

Six Sigma approach performance is evaluated according to the quality costs. The process is aimed at reducing the cost of poor quality improvement (Aslan and Demir, 2005). Given the global competitive factors, classic quality management approaches, businesses have not recorded enough of success to capture the long term. However, the emergence of the six sigma approach has to a very large extent have massive positive impact in terms of quality and have succeeded in bringing about success stories in terms of business performance and the greater quality of services (Ada and Aracıoğlu,2004).

Table 1. Six Sigma Essential Themes

1	A genuine focus on the customer
2	Data-and fact –driven management
3	Process focus, management, and improvement
4	Proactive management
5	Unlimited collaboration
6	A drive for perfection, and yet a tolerance for failure

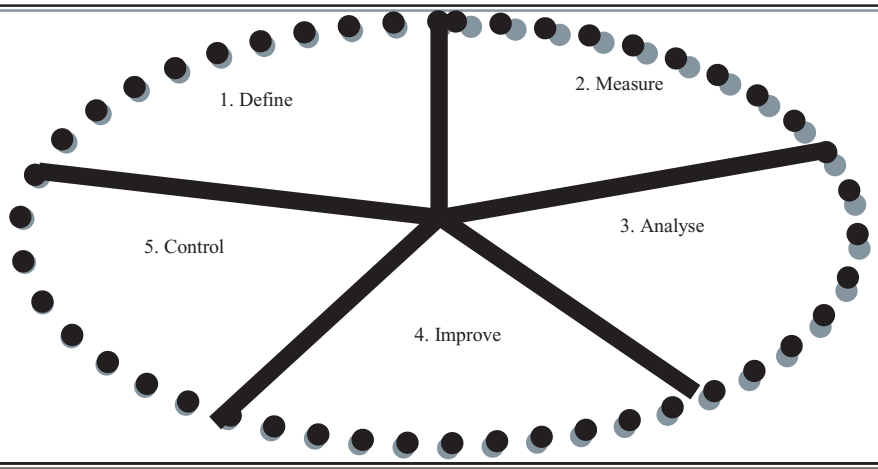
References: (Pande, P.S., Neuman, R.P. and Cavanagh, R.R., 2000)

Table 1 shows the six sigma six concept. Accordingly, a genuine focus on the customer information and data management, process focus management and improvement, proactive management, unlimited collaboration, excellence-driven and tolerance for failure.

In the literature, the increasing profitability of enterprises, improve processes, improvement of methodology to reduce cost can be found. Six Sigma process improvement projects are conducted by using the DMAIC methodology (Türkan Y. S., Manisalı E. and Çelikkol M.F,2009). The DMAIC methodology consists of five phases: Define, Measure, Analyse, Improve, and Control (Ada and Aracıoğlu ,2004).

In Figure-1, improvement model for Six Sigma (DMAIC) components are given. They include, the definition phase and the basic framework of the project to implement the Six Sigma process is determined. The main objective of the project priorities is determined by contributions to business and environmental interests, the needs of the project. The source needs to be configured and flow structure of the project is defined. Identification of important variables related to the measurement process in the project, identification of measurable characteristics and targeted data collection. Relations and interactions between process variables in the analysis phase are also analysed. The potential sources of problems are identified. In the process of restructuring, problems are also identified and solutions are found to solve them.

Figure 1. The DMAIC Six Sigma Improvement Model



References: (Pande, P.S., Neuman, R.P. and Cavanagh, R.R., 2000)

Table 2 shows the stages of Six Sigma (DMAIC) and some of the tools and techniques used. Accordingly, the table shows the tools and techniques in a more detail format.

Table 2. Six Sigma Phases (DMAIC) and Used Some of the Tools and Techniques

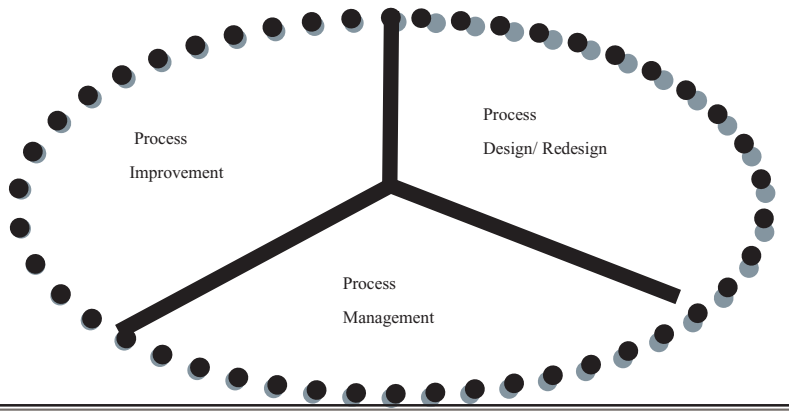
	DMAIC Phase Steps		The tools and methods
Characterization	Define	Ensuring that the problem and goal are defined in terms that truly relate to key customer requirements	Project Charter Process Flowchart SIPOC Diagram Stakeholder Analysis CTQ Definitions
	Measure	Tested the output and input potential. Once it has determined the right measurement system for adequacy of available inputs and outputs.	Process Flowchart Data Collection Plan/Example Benchmarking Measurement's System Analysis/Gage R&R Process Sigma Calculations
	Analyze	Define Performance Objectives Identify Value/Non-Value Added Process Steps Identify Sources of Variation Determine Root Cause(s) Determine Vital Few x's, Y=f(x) Relationship	Histogram Pareto Chart Regression Analysis Process Map Review and Analysis Statistical Analysis Hypothesis Testing Non-Normal Data Analysis
Optimization	Improve	Perform Design of Experiments Develop Potential Solutions Define Operating Tolerances of Potential System Assess Failure Modes of Potential Solutions Validate Potential Improvement by Pilot Studies Correct/Re-Evaluate Potential Solution	Brainstorming Mistake Proofing Design of Experiments Pugh Matrix Failure Modes and Effects Analysis
	Control	After optimized the output for the sake of continuity, and in selected cases of important input just to check if continued, will help to reduce the variability of the output.	Process Sigma Calculation Control Charts Cost savings Calculations Control Plan

References: (Türkan Y. S., Manisalı E. and Çelikkol M.F., 2009)

Six Sigma offers three basic strategies for achieving successful to company goals. These are shown in Figure 2. Accordingly, one of the basic process is improvement strategy. The whole process of the business strategy is sought to be improved to achieve the objectives of the company. At this point, the equivalent of competitors and the past performance of the company, it is an important indicator for improvement. The design and redesign, it always aims to redesign of process structure, components and interactions. In the process management, improve process as well as design, they also considering the internal and external environment of the company and trying to manage effectively.

Six sigma in parallel for process management, it should be applied in all activities of company, not a few episodes. When the quality control system focused on the correlation of errors identified, Six Sigma provides a structured way in order to avoid any more errors. And it also helps in bringing a paradigm shift during the improvement or re-

Figure 2. Main Strategies of Six Sigma



References: Pande, P.S., Neuman, R.P. and Cavanagh, R.R., 2000

designing of process (Ada and Aracıoğlu ,2004).

2.3. Six Sigma roles in the organization

Six Sigma is different from other approaches and organizational structures. In the organizations of Six Sigma, different titles, authorities and responsibilities are given to staffs depending on the type of education that they had received (George S. Easton,2012; Scott M. Shafer,2012; Weimin Ye,2013). Given the different scope and activities in the organization, the six sigma approach seeks to ensure that all the process is effectively coordinated and makes all processes much easier. This is all aimed at carrying out healthy projects (TürkanY.S., Manisalı E. and Çelikkol M.F.,2009)

Table 3. Examples of variation in generic roles and Belt or other titles.

1	Leadership Council	Quality Council, Six sigma Steering Committee
2	Sponsor	Champion, Process Owner
3	Implementation leader	Six Sigma Director, Quality Leader, Master Black Belt
4	Coach	Master Black Belt or Black Belt
5	Team Leader	Black Belt or Green Belt
6	Team Member	Team Member or Green Belt
7	Process Owner	Sponsor or Champion

References: (Pande, P.S., Neuman, R.P. and Cavanagh, R.R., 2000)

Table- 3 showes the roles and titles/ generations of Six Sigma. Accordingly, those leadership council composed of senior executives. They build the relationship between strategic objectives and the Six Sigma approaches of company. They observe and operate the Six Sigma process for sponsors, champions and senior managers. And make necessary improvements to increase performance. During the successful implementation of Six Sigma, the high level leader is responsible for some projects which provides coordination with other unites, if necessary. Guides are observing the system's technical performants as technical advisor and make recommendations for improvement. Team leaders make some necessary observation, arrangement and improvements to ensure the success of the team and projects. Team members are the technical personnels obtained necessary knowledge and equipment. The process owners are those who manage the cross-relationships and flows between projects and clients.

As shown in Six Sigma approaches as well as to its basic principles, stages, strategies, it has a hierarchical administrative structure in order to manage effectively. Thus Six Sigma system is becoming more efficient and functional (Bertels, T. ,2003).

3. Research Design and Data Analysis

When a company wants to improve the Six Sigma approach, it is necessary to know the basic road map.

Six Sigma started re-evolution for the whole process and also aim at increasing profitability for businesses with focus on customer satisfaction. Subsequently, performed mathematical measurement and analysis on customer criteria, processes, input and output values, performances. Six Sigma envisages a near perfect success of the criteria laid down by the customer, it aims to reduce statistical error rate below 3.4 million. Results in quantitative methods of six sigma that applied in parallel with the customer satisfaction and based on process approach have shown the following results: reduced error rates, cycle time is shortened, inventory levels are falling, productivity increases, costs reduces, and it

provided the profitability with the higher customer satisfaction and increasing of market share (Ada and Aracıoğlu ,2004).

Table 4. shows the implementation process of Six Sigma road map. Accordingly, the first phase should begin by key processes and defining the key customers. If you define the customers well, the process will be more effective and the results will be more successful. In the second stage, it corresponds to detection of the customers needs who had been defined. In the third step, measure the current performance of the productivity. For this data, the data are collected and arranged for critical variables. In the fourth step, making priority ranking, analysis and improvements for all variables, conditions and objectives sequentially. In the final stage; managing, integrating and disseminating the process is successful for Six Sigma.

Table 4. The Six Sigma Core Process ___ Road Map	
1	Identify core processes and key customers
2	Define customer requirements
3	Measure current performance
4	Prioritize, analyze, and implement improvements
5	Expand and integrate the Six Sigma system (manage process for Six Sigma performance)
References: (Pande, P.S., Neuman, R.P. and Cavanagh, R, R., 2000)	

The acquisitions will be increased, if Six Sigma processes and factors are well recognized and managing regularly. The effect of the application-level and project success can display the varieties according to the country and industry. The Critical Success Factors are generally accepted in the literature given below (TürkanY.S., Manisalı E. and Çelikkol M.F.,2009):

- The Participation of the Management and Commitment
- Cultural Exchange
- Organizational Infrastructure
- Education
- Project Management Skills
- Project Prioritization and Selection
- The Tools and Techniques Understandings in the Six Sigma Methodology
- The operating Strategy associate with Six Sigma
- Associating the Six Sigma with customers
- Associating Six Sigma with Human Resources
- Associating Six Sigma with suppliers
- Communication
- Information Technology Infrastructure

The business which is based on the implementation of the Six Sigma philosophy with the right quality of the customer satisfaction, and to capture the rapid changes in the technological field with customer needs and expectations will be able to fulfil the requirements of heavy competition in the world. There are several factors behind the failure of Lean Six Sigma work. These factors includes the lack of senior management support and leadership, lack of competence of lean six sigma team, inaccuracies in project selection, lack of education, cultural exchanges, the lack of strategy, customer's voice, as can be listed. It should be noted that it is not short term settlement for this philosophy in companies that will make it to achieve its overall objectives. Instead, it has to be in the long run in order to achieve its objectives.

Various research methods were applied in this research paper. We selected the white goods industry leaders in Turkey's top 500 enterprises. X White goods company was used for this study. We conducted interviews about the management of the various branches of the organization in the form of discussions and question sessions. We presented the effects of six stigmas on white goods company in Table 5.(The survey, six sigma implementation and results of the evaluation of experts and managers and staff performing official results were obtained) Accordingly, due to the implementation of the six sigma practices, the company's performance improved significantly, 20-39% in the development of new technology, 40-59% in the new product development, 20-39% in the count of innovation, 80-100% in costs, productivity and profitability, 60-79% in competitiveness and 40-59% in customer satisfaction and its market share in Turkey has contributed to improvements in employee satisfaction rate of 60-79%.

Table 5. The Effects of a White Goods Company for Six Sigma Implementation

Improvement areas		Effects on the improvement oh the performance				
		%0-19	%20-39	%40-59	%60-79	%80-100
1	Development of new technology		X			
2	Development of new products			X		
3	İnnovation count		X			
4	Costs					X
5	Productivity					X
6	Profitability					X
7	Competitiveness				X	
8	Customer satisfaction				X	
9	Employee Satisfaction			X		
10	Market share in Turkey				X	

Source: the survey results made by the author

4. Conclusion

The Six Sigma approach which began to develop in the 1980s, has great potentials in improving the organizational competitive advantage among other competitors. In the study, it has been demonstrated that the implementation of the six sigma approach on the white goods company have tremendously help to increase the organizational performance.

In the study, according to the survey results derived from white goods company in the implementation of the Six Sigma approach, the performance improvement contribution to the company is as follows: 20-39% in the development of new technology, 40-59% in the development of new product, 20-39% in the count of innovations, 80~100% in the costs, in the productivity and in the profitability, 60-79% in the competitiveness and customer satisfaction, 40-59% in the employee satisfaction and 60-79% market share in Turkey has resulted to a conclusion that the six sigma approach have positive impacts on the white goods company.

Giving the current situation, enterprises are under the increasing pressure from global competition to increase their competitiveness, reduce their costs, increase their productivity and most importantly, should take advantage of the event from the six sigma approach to improve in a sustainable manner.

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